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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/788,105	02/16/2001	Jay E. Uglow	LAM1P106D	2844

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MARTINE & PENILLA, LLP
710 LAKEWAY DRIVE
SUITE 170
SUNNYVALE, CA 94085

EXAMINER

FINSMITH, DAVID C

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 12/28/2001

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/788,105

Applicant(s)

UGLOW ET AL.

Examiner

David C Finsmith

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 February 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-24 and 26-41 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-24 and 26-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 February 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

1. Claim 21 is rejected under 35 U.S.C. 102(e) as being unpatentable by Wang et al (U.S. Patent Number 6,287,955)

Wang et al teach a multi-layer dielectric layer over a substrate for use in dual-damascene applications, comprising:

a barrier layer disposed over the substrate;
an inorganic dielectric layer disposed over the barrier layer; and a low dielectric constant layer disposed directly over the inorganic layer; wherein the inorganic low dielectric constant layer is configured to receive metallization line trenches and the low inorganic dielectric constant layer is configured to receive a dual-damascene process. (see figure 1 and columns 2 and 3).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 29, 31, 34, 35, 36, 38-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al.

In regard to claim 29, Wang et al discloses the claimed invention except for the thickness of the low dielectric constant layer being greater than the thickness of the inorganic dielectric layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the layers so that the thickness of the low dielectric constant layer would be greater than the thickness of the inorganic dielectric layer in order to optimize the amount of carbon introduced into the respective layers, since it has been held that the provision of adjustability, where needed, involves only routine skill in the art.

(In re Stevens, 101 USPQ 284 (CCPA 1954).

In regard to claim 31, Wang et al discloses the claimed invention except for a barrier layer over a base dielectric layer and the inorganic dielectric layer formed of an undoped TEOS oxide and the low dielectric constant layer formed of a carbon doped oxide.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the structure of Wang et al with the respective dielectric layers formed of the respective materials of the instant invention and combine them in a structure where the barrier layer is disposed over the base dielectric layer in order to protect the base dielectric layer from diffusion and electromigration and choose an

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advantageous selectivity for the dielectric layers during etching, since it has been held that a mere reversal of parts of a device involves only routine skill in the art and it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. (In re Einstein, 8 USPQ 167 and In re Leshin, 125 USPQ 416).

In regard to claim 34, Wang et al discloses the claimed invention except for the thickness of the low dielectric constant layer of a carbon doped oxide being greater than the thickness of the inorganic dielectric layer of an un-doped TEOS oxide.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the layers and their compositions so that the thickness of a low dielectric constant layer of a carbon doped oxide would be greater than the thickness of an inorganic dielectric layer in order to optimize the amount of carbon introduced into the respective layers, since it has been held that the provision of adjustability, where needed, involves only routine skill in the art and since it has been held that the provision of adjustability, where needed, involves only routine skill in the art.

(In re Stevens, 101 USPQ 284 (CCPA 1954) and In re Leshin, 125 USPQ 416).

In regard to claim 35, Wang et al discloses the claimed invention except for a low dielectric constant layer of a carbon doped oxide and the inorganic dielectric layer of an undoped TEOS oxide of about 10,000 angstroms, and the thickness of the inorganic dielectric layer of an un-doped TEOS oxide about 1,000 angstroms.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the respective layers to the respective thicknesses specified above in order to optimize the selectivity of the layers during etching, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum value of a result effective variable involves only routine skill in the art. (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

In regard to claim 36, Wang et al discloses the claimed invention except for a barrier layer over a base dielectric layer and the inorganic dielectric layer formed of a fluorine doped oxide and the low dielectric constant layer formed of a carbon doped oxide.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the structure of Wang et al with the respective dielectric layers formed of the respective materials of the instant invention and combine them in a structure where the barrier layer is disposed over the base dielectric layer in order to protect the base dielectric layer from diffusion and electromigration and choose an advantageous selectivity for the dielectric layers during etching, since it has been held that a mere reversal of parts of a device involves only routine skill in the art and it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. (In re Einstein, 8 USPQ 167 and In re Leshin, 25 USPQ 416).

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In regard to claim 38, Wang et al discloses the claimed invention except for a low dielectric constant layer of a carbon doped oxide with a thickness of about 5000 angstroms.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the low dielectric constant layer of a carbon doped oxide layer to be about 5000 angstroms in order to optimize the selectivity of the layer during etching, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum value of a result effective variable involves only routine skill in the art. (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

In regard to claim 39, Wang et al discloses the claimed invention except for the thickness of the low dielectric constant layer of a carbon doped oxide being greater than the thickness of the inorganic dielectric layer of a fluorine doped oxide.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the layers and their compositions in the device of Wang et al so that the thickness of the low dielectric constant layer of a carbon doped oxide would be greater than the thickness of the inorganic dielectric layer of a fluorine doped oxide in order to optimize the amount of carbon introduced into the respective layers, since it has been held that the provision of adjustability, where needed, involves only routine skill in the art and since it has been held that the provision of adjustability, where needed, involves only routine skill in the art.

(In re Stevens, 101 USPQ 284 (CCPA 1954) and In re Leshin, 125 USPQ 416).

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In regard to claim 40, Wang et al discloses the claimed invention except for a low dielectric constant layer of a carbon doped oxide and the inorganic dielectric layer of fluorine doped oxide being about 10,000 angstroms, and the thickness of the inorganic dielectric layer of a fluorine doped oxide about 1,000 angstroms.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the respective layers to the respective thicknesses specified above in order to optimize the selectivity of the layers during etching, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum value of a result effective variable involves only routine skill in the art. (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

In regard to claim 41, Wang et al discloses the claimed invention except for a low dielectric constant layer of a carbon doped oxide and an inorganic dielectric layer of a fluorine doped oxide;

Wherein a thickness of the inorganic dielectric layer of a fluorine doped oxide is about 4500 angstroms and wherein the thickness of the low dielectric constant layer of a carbon doped oxide is greater than the thickness of the inorganic dielectric layer of a fluorine doped oxide;

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the structure of Wang et al with the respective dielectric layers having the limitations as stated above in order to improve the selectivity of the layers during etching and provide a via of a predetermined height, since it has been held that the provision of adjustability where needed, involves only routine skill in the art

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and it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. (In re Leshin, 125 USPQ 416 and In re Stevens, 101 USPQ 284 (CCPA 1954).

3. Claims 22, 27, 28, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al in view of Chang et al (U.S. Patent Number 6,319,809)

In regard to claim 22, Wang et al discloses the claimed invention as discussed in paragraph 1 above except for a barrier layer that is either Silicon Nitride or Silicon Carbide.

Chang et al discloses a barrier layer that is either Silicon Nitride or Silicon Carbide (see column 5 lines 50-55).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a barrier layer of Silicon Nitride or Silicon Carbide in the device of Wang et al to improve the diffusion resistance of the device.

In regard to claim 27, Wang et al disclose the claimed invention except for an inorganic dielectric layer with a thickness of about 4500 angstroms.

Chang et al disclose an inorganic dielectric layer with a thickness of about 4500 angstroms (see column 5 lines 55-60).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the inorganic layer to be about 4500 angstroms in the device of Wang et al in order to optimize the planarization of the device and to select a via of a predetermined height.

In regard to claim 28, Wang et al discloses the claimed invention except for a low dielectric constant layer with a thickness of about 5000 angstroms.

Chang et al disclose a low dielectric constant layer with a thickness of about 5000 angstroms (see column 7).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the inorganic layer to be about 5000 angstroms in order to optimize the planarization of the device and provide a via of a predetermined height.

In regard to claim 30, Wang et al discloses the claimed invention except for a low dielectric constant layer and the inorganic dielectric layer being about 10,000 angstroms, and the thickness of the inorganic dielectric layer about 1,000 angstroms (see columns 5, 7, and 8).

Chang et al disclose a low dielectric constant layer and the inorganic dielectric layer being about 10,000 angstroms, and the thickness of the inorganic dielectric layer about 1,000 angstroms (see columns 5, 7, and 8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the respective layers to the respective thicknesses specified above in the device of Wang et al in order to optimize the selectivity of the layers during etching

4. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al in view of Wolf (Silicon Processing Volume 2).

Wang et al discloses the claimed invention except for an inorganic dielectric layer of undoped TEOS oxide or a fluorine doped oxide.

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Wolf discloses inorganic dielectric layers of either undoped TEOS oxide or fluorine doped oxide (see Silicon Processing by Wolf Volume 2 page 194)

It would have been obvious to one of ordinary skill in the art at the time the invention was made in view of the teaching of Wolf to form an inorganic dielectric layer in the device of Wang from undoped TEOS oxide or from a fluorine doped oxide to improve the range of selectivity for the inorganic dielectric layer during etching.

5. Claim 24, 33, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al in view of Chao-Cheng Chen et al (U.S. Patent Number Number 6,025,273), and Lai-Juh Chen et al(U.S. Patent Number 5,858,869).

In regard to claim 24 Wang et al discloses the claimed invention except for a low dielectric constant layer of a carbon doped oxide.

Lai-Juh Chen et al teach a low dielectric constant layer of a carbon doped oxide (see U.S. Patent Number 5,858,869) column 5 lines 1-20).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a low dielectric constant layer in the device of Wang et al from a carbon doped oxide to improve the range of selectivity for the layer during etching.

In regard to claim 33, Wang et al discloses the claimed invention except for a low dielectric constant layer of a carbon doped oxide with a thickness of about 5000 angstroms..

Chao-Cheng Chen et al discloses a low dielectric constant layer of a carbon doped oxide with a thickness of about 5000 angstroms (see column 4).

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the low dielectric constant layer of in the device of Wang et al from a carbon doped oxide layer to be about 5000 angstroms in order to optimize the selectivity of the layer during etching.

In regard to claim 37, Wang et al discloses the claimed invention except for an inorganic dielectric layer of a fluorine doped oxide with a thickness of about 4500 angstroms.

Lai-Juh Chen et al discloses an inorganic dielectric layer of a fluorine doped oxide with a thickness of about 4500 angstroms (see column 6 lines 50-65).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the inorganic dielectric layer of Wang et al from a fluorine doped oxide to be about 4500 angstroms in order to optimize the selectivity of the layer during etching.

6. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al in view of Jang et al (U.S. Patent Number 6,165,898)

Wang et al discloses the claimed invention except for an inorganic dielectric layer with different material properties than the low dielectric constant layer.

Jang et al discloses an inorganic dielectric layer with different material properties than the low dielectric constant layer (see abstract).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form in the device of Wang et al an inorganic dielectric layer with

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different material properties than the low dielectric constant layer to adjust the differential of the etching rates between the two layers.

7. Claims 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al in view of Hong (U.S. Patent Number 6,069,058).

Wang et al discloses the claimed invention except for an inorganic dielectric layer of an undoped TEOS oxide with a thickness of about 4500 angstroms.

Hong discloses an inorganic dielectric layer of an undoped TEOS oxide with a thickness of about 4500 angstroms (see column 6 lines 1-5).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the inorganic dielectric layer in the device of Wang et al from an undoped TEOS oxide to of 4500 angstroms in order to optimize the selectivity of the device during etching.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David C Finsmith whose telephone number is 703-308-0121. The examiner can normally be reached between 8 A.M.-5 P.M. from Monday - Friday

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers can be reached on 703-308-2417. The fax phone numbers for TC 2800 where this application is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-6785.

Charles S. Bowers Jr.
Charles Bowers
Supervisory Patent Examiner
Technology Center 2300